TUMBLER FOR ARTIFICIALLY AGEING THE APPEARANCE OF CONCRETE BLOCKS

Field of the invention

The present invention relates to an apparatus for imparting to concrete blocks an aged or weathered appearance.

Background of the invention

Concrete b locks intended to serve as pavers (also known as paving stones), bricks, ornamental blocks, steps, retaining wall blocks, or the like are sometimes treated in order to have an aged or weathered appearance. Such treated concrete blocks can then be assembled into structures that have a more natural, esthetically-pleasing appearance.

A treatment for artificially ageing the appearance of concrete blocks is generally required since concrete blocks prepared using conventional manufacturing operations such as casting, cutting, and/or drying typically produce blocks that have a geometrically rectangular configuration, wherein the surfaces of the blocks are substantially planar with adjacent surfaces delimited by sharp edges.

One known method of roughing the surfaces, edges, and corners of concrete blocks consists in introducing the blocks into a large tumbling drum. The tumbling drum is rotated about its longitudinal axis in order to cause the concrete blocks to tumble therein. The multiple random collisions between the concrete blocks damage the surfaces, edges, and corners of the blocks thereby imparting to the blocks an aged or worn appearance. The concrete blocks are eventually dumped in bulk from the tumbling drum and form a pile of disorganized blocks. Manual labor is then required to handle the blocks, which are typically sorted and palletized for storage or transport to another location.

Now, designs for structures of concrete blocks such as pavers, bricks, retaining wall blocks, or the like frequently require blocks of different sizes and configurations. For instance, a design for paving a driveway or other pavement surface in front of a house frequently requires pavers of multiples sizes and configurations in order to achieve a certain pattern.

In order to supply the required concrete blocks for a given design, a manufacturer of such blocks typically must resort to one of the following. If blocks tumbled in the tumbling drum of the manufacturer are all of the same configuration, the manufacturer must transport to a client location either a different pallet of blocks for each different size and/or configuration of blocks required by a particular design, or one or more pallets on which have been stacked blocks originating from multiple batches dumped from the tumbling drum.

On the other hand, if blocks tumbled in the tumbling drum of the manufacturer include all of the block configurations required for a given design, manual labor is still required for sorting the blocks dumped in a disorganized fashion from the tumbling drum and stack the proper number of blocks of each configuration on the one or more pallets transported to the client location.

The above problems and drawbacks are a direct consequence of the structure of known tumbling drums, which only enables concrete blocks to be tumbled in bulk and dumped in a pile of disorganized blocks.

There is therefore a need in the industry to provide an apparatus for artificially ageing the appearance of concrete blocks that alleviates at least in part the problems associated with existing tumbling drums.

Summary of the invention

In accordance with a broad aspect, the invention provides a tumbler for artificially ageing the appearance of surfaces, edges, and corners of concrete blocks. The tumbler comprises a container having a longitudinal axis and comprising a plurality of compartments, each compartment being separated from an adjacent compartment by a partition transverse to the longitudinal axis of the container. The tumbler further comprises a door coupled to the container, the door being movable from a first position to a second position. In the first position, the door allows the concrete blocks to be loaded into or unloaded from at least one of the plurality of compartments. In the second position, the door maintains the concrete blocks within the at least one of the plurality of compartments such that rotation of the container about the longitudinal axis causes the concrete blocks to tumble and collide with each other.

In accordance with another broad aspect, the invention provides an apparatus for artificially ageing the appearance of surfaces, edges, and corners of concrete blocks. The apparatus comprises a frame and a plurality of tumblers coupled to the frame. At least one of the plurality of tumblers is rotatably coupled to the frame and comprises a container having a longitudinal axis and comprising a plurality of compartments, each compartment being separated from an adjacent compartment by a partition transverse to the longitudinal axis of the container. The at least one of the plurality of tumblers further comprises a door coupled to the container, the door being movable from a first position to a second position. In the first position, the door allows the concrete blocks to be loaded into or unloaded from at least one of the plurality of compartments. In the second position, the door maintains the concrete blocks within the at least one of the plurality of compartments such that rotation of the container about the longitudinal axis causes the concrete blocks to tumble and collide with each other.

These and other aspects and features of the present invention will now become apparent to those of ordinary skill in the art upon review of the following description of specific embodiments of the invention in conjunction with the accompanying drawings.

Brief description of the drawings

A detailed description of the embodiments of the present invention is provided herein below, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows a top view of a system for artificially ageing the appearance of concrete blocks in accordance with an embodiment of the present invention;

Figure 2 shows a perspective view of a tumbler for artificially ageing the appearance of concrete blocks in accordance with a first embodiment of the present invention;

Figure 3 shows an end elevational view of the tumbler of Figure 2 with its door in a close position;

Figure 3A is a cross-sectional view taken along lines 3A-3A;

Figure 4 shows a side elevational view of the tumbler of Figure 3;

Figure 5 shows an end elevational view of the tumbler of Figure 2 with its door in an open position;

Figure 5A is a cross-sectional view taken along lines 5A-5A;

Figure 6 shows the side elevation view of the tumbler of Figure 5;

Figure 7 shows a perspective view of a tumbler for artificially ageing the appearance of concrete blocks in accordance with a second embodiment of the present invention;

Figure 8 shows an end elevational view of the tumbler of Figure 7 with its door in the open position;

Figure 8A is a cross-sectional view taken along lines 8A-8A;

Figure 9 shows a side elevational view of the tumbler of Figure 8;

Figure 10 shows a top view of a tumbler for artificially ageing the appearance of concrete blocks in accordance with a particular embodiment of the present invention, wherein the tumbler comprises certain internal features;

Figure 10A is a cross-sectional view of the tumbler of Figure 10;

Figure 11 shows a perspective view of an apparatus for artificially ageing the appearance of concrete blocks in accordance with a particular example of implementation of the present invention;

Figure 12 shows an end elevational view of the apparatus of Figure 11;

Figure 13 shows a side elevational view of the apparatus of Figure 11; and

Figure 14 shows an example of a possible layout of concrete blocks intended to have their appearance artificially aged.

In the drawings, the embodiments of the invention are illustrated by way of examples. It is to be expressly understood that the description and drawings are only for the purpose of illustration and are an aid for understanding. They are not intended to be a definition of the limits of the invention.

Detailed description of specific embodiments

Figure 1 illustrates a system 10 for artificially ageing the appearance of concrete blocks in accordance with an embodiment of the invention. The system 10 receives concrete blocks 12 that have been prepared using conventional processing operations, such as casting,

cutting, and/or drying of the blocks 12. The received concrete blocks 12 typically have a geometrically rectangular configuration, wherein the surfaces of the blocks are substantially planar with adjacent surfaces delimited by sharp edges. The concrete blocks 12 may have different sizes and shapes and may be intended to eventually be used as pavers (also known as paving stones), bricks, steps, retaining wall blocks, or the like.

The concrete blocks 12 are disposed on a platform 14 that is adapted to move on a first conveyor 16. On the platform 14, the concrete blocks 12 are typically arranged in a certain layout which is the result of a prior processing operation. An example of a possible layout of the concrete blocks 12 is shown in Figure 14. In that particular example, the concrete blocks 12 are arranged in six rows of blocks having different dimensions, adjacent rows of blocks being separated by a certain distance.

Reverting to Figure 1, the conveyor 16 moves the platform 14 to a first position, denoted P1, where a pusher mechanism 18 pushes the concrete blocks 12 onto a second conveyor 20. The second conveyor 20 may a belt-type conveyor and may comprise a plurality of separating walls that define a plurality of channels 22. The pusher mechanism 18 is adapted to push the concrete blocks 12 of each row of blocks 12 on the platform 14 into a respective channel 22 of the conveyor 20.

The conveyor 20 conveys the concrete blocks 12 in each of the channels 22 toward an apparatus 24 for artificially ageing the appearance of the concrete blocks. The apparatus 24 comprises a plurality of tumblers 26 coupled to a frame 28. Each tumbler 26 comprises a container 46 divided into a plurality of compartments 48 and is adapted to allow rotation of the container 46 about the container's longitudinal axis. The frame 28 is adapted to sequentially move each one of the tumblers 26 from a block loading position, denoted by BLP, to a block unloading position, denoted by BUP. The apparatus 24, including the tumblers 26 and the frame 28, will be described in further detail below.

The concrete blocks 12 on the conveyor 20 eventually reach the block loading position BLP where they are loaded into one of the tumblers 26. More specifically, at the block

loading position BLP, the tumbler 26 is positioned in relation to the conveyor 20 such that each respective compartment 48 of the tumbler 26 is aligned with a respective channel 22 of the conveyor 20 allowing the concrete blocks 12 in each one of the channels 22 to be loaded into a respective compartment 48 of the tumbler 26. Once the concrete blocks 12 are loaded, the frame 28 proceeds to move the tumbler 26 to the block unloading position BUP.

During movement of the tumbler 26 from the block loading position BLP to the block unloading position BUP, the container 46 of the tumbler 26 rotates about its longitudinal axis. Under rotation of the container 46, the concrete blocks 12 in each one of the compartments 48 tumble and collide with each other and with internal features of the container 46. The multiple random collisions between the concrete blocks 12 and between the concrete blocks 12 and internal features of the container 46 damage the surfaces, edges, and corners of the concrete blocks 12 thereby imparting to the blocks 12 an aged or worn appearance.

When the tumbler 26 containing the concrete blocks 12 reaches the block unloading position BUP, the blocks 12 are unloaded onto a third conveyor 32. The third conveyor 32 may be a belt-type conveyor and may comprise a plurality of separating walls that define a plurality of channels 34. Thus, at the block unloading position BUP, the tumbler 26 is positioned in relation to the conveyor 32 such that each respective compartment 48 of the tumbler 26 is aligned with a respective channel 34 of the conveyor 32 allowing the concrete blocks 12 in each respective compartment 48 of the tumbler 26 to be unloaded into a respective one of the channels 34 of the conveyor 32. The conveyor 32 then conveys the concrete blocks 12 in each of the channels 34 toward a position denoted P2.

The concrete blocks 12 arrive, at position P2, on a fourth conveyor 36 and are directed towards a fifth conveyor 38 by a second pusher mechanism 40. Upon reaching the fifth conveyor 38, the concrete blocks 12 are directed towards the first conveyor 16 by a third pusher mechanism 42. The blocks 12 eventually reach a position denoted P3 where they

are placed on the platform 14, which has moved from position P1 on the first conveyor 16, by a fourth pusher mechanism 44.

Once on the platform 14, the concrete blocks 12 may be directed to another location where they may be submitted to another processing operation or treatment. Alternatively, the concrete blocks 12 may form a layer of a pallet that may subsequently be stored or transported to another location. In that case, the concrete blocks 12 may be palletized through manual labor or automatically palletized by way of a palletizing device. Of course, it will be appreciated that the fourth and fifth conveyors 36 and 38, along with the second, third, and fourth pusher mechanisms 40, 42, and 44 are optional and may be omitted in which case the concrete blocks 12 may be placed, for instance, on another platform (not shown) located at position P2. The concrete blocks 12 could then either be submitted to a further processing operation or palletized as described above.

It will thus be appreciated that the plurality of compartments 48 of the tumbler 26 allow the concrete blocks 12 introduced therein to be tumbled while maintaining together in each respective compartment 48 the blocks originally being part of each row of blocks 12 on the platform 14. Upon unloading of the concrete blocks 12 from the tumbler 26 onto the conveyor 32, the blocks 12 originally being part of each respective row of blocks 12 are thus in the same respective channel 34 of the conveyor 32. Hence, when the concrete blocks 12 arrive on the platform 14 at position P3 (or, if that is the case, the platform (not shown) located at position P2), the blocks 12 originally being part of each respective row of blocks 12 are still in the same respective row. In other words, the concrete blocks 12 being part of a particular row of blocks 12 in a given layout of blocks prior to being tumbled in the tumbler 26 are part of the same row of blocks in the layout of blocks after being tumbled in the tumbler 26. As such, the layout of concrete blocks 12 after the blocks have been tumbled in and unloaded from the tumbler 26 is the same as the original layout of concrete blocks 12 prior to their introduction into the tumbler 26.

For instance, the concrete blocks 12 of the example layout of blocks 12 shown in Figure 14 may be loaded into the tumbler 26 with blocks B1 and C1 of row R1 being loaded into

a first compartment 48 of the tumbler 26, blocks A2 and D2 of row R2 being loaded into a second compartment 48 of tumbler 26, and so on. After being tumbled and unloaded from the tumbler 26, the resulting layout of blocks has a first row that includes blocks B1 and C1, a second row that includes blocks A2 and D2, etc.

Reverting to Figure 1, during movement of the tumbler 26 from the block loading position BLP to the block unloading position BUP, the frame 28 has positioned another one of the tumblers 26 at the block loading position BLP. This other one of the tumblers 26 receives another set of concrete blocks 13 transported from a platform 15 to the block loading position BLP via the first conveyor 16, the pusher mechanism 18, and the second conveyor 20, as described previously. The concrete blocks 13 are then tumbled in this other one of the tumblers 26, unloaded at the block unloading position BUP, and make their way to position P3 where they are placed on the platform 15, as described above. Generally, while some of the tumblers 26 are moving from the block loading position BLP to the block unloading position BUP and tumbling respective sets of concrete blocks, one of the tumblers 26 is being loaded with a respective set of concrete blocks at the block loading position BLP and another one of the tumblers 26 is being unloaded of a respective set of concrete blocks at the block unloading position BUP.

Thus, owing to the sequential movement of each one of the plurality of tumblers 26 from the block loading position BLP to the block unloading position BUP, it will be appreciated that multiple sets of concrete blocks can be tumbled simultaneously. Accordingly, a larger number of concrete blocks having an aged or weathered appearance can be produced per unit time thereby increasing the efficiency of the process.

Having described a particular embodiment of the system 10, specific embodiments of the apparatus 24, including the tumblers 26 and the frame 28, will now be described.

Figures 2 to 6 illustrate a tumbler 26 for artificially ageing the appearance of surfaces, edges, and corners of concrete blocks, in accordance with an embodiment of the invention. The tumbler 26 comprises a container 46 having a longitudinal axis and

comprising a plurality of compartments 48. Each compartment 48 is separated from an adjacent compartment by a partition 50 transverse to the longitudinal axis of the container 46.

In the specific embodiment shown in Figures 2 to 6, each one of the compartments 48 is defined by a separate sub-container 51. As shown in Figure 2, each sub-container 51 has a peripheral wall 51C and sidewalls 51A and 51B that together define an internal compartment 48 and an opening giving access to the internal compartment 48. In this embodiment, a partition 50 separating adjacent compartments 48 is realized by one of the sidewalls 51A and 51B of each adjacent sub-container 51 (e.g., sidewall 51A of one sub-container 51 and sidewall 51B of an adjacent sub-container 51). The separate sub-containers 51 defining the plurality of compartments 48 are aligned next to each other and are maintained fixed between two end plates 52 that are detachably coupled to each other by longitudinally extending bars 54. This particular assembly of the container 46 allows any particular one of the sub-containers 51 to be independently removed and replaced by another sub-container 51. Furthermore, each sub-container 51 defines a compartment 48 characterized by a width that is measured parallel to the longitudinal axis of the container 46. In the example shown, the width of the compartment 48 defined by each sub-container 51 is the same, although it is possible to use sub-containers 51 each defining a compartment 48 characterized by a different width. It is thus possible to replace any particular one of the sub-containers 51 by a replacement sub-container 51 defining a compartment 48 of a different size than the compartment 48 defined by the replaced sub-container 51. This allows, for example, the compartments 48 of the container 46 to have sizes tailored to different sizes of concrete blocks to be loaded into and tumbled by the tumbler 26.

Figures 7 to 9 show an alternate embodiment in which the container 46 is a one-piece container that does not include sub-containers 51, but rather has physical partitions (or separation walls) 50 coupled to the container 46 for separating each pair of adjacent compartments 48. In that embodiment, each partition 50 can be independently mounted at different positions within the container 46 for allowing an adjustment of the size of each

one of the adjacent compartments 48 that it separates. A partition 50 can also be independently removed from or introduced into the container 46 for respectively decreasing or increasing the number of compartments 48 of the container 46. Alternatively, the tumbler 26 may have partitions 50 integrally formed with the container 46 for separating each pair of adjacent compartments 48.

Although in the illustrated embodiments the container 46 is essentially a cylindrical structure, it is understood that the container 46 may be of any geometrical configuration, such as a rectangular or any other polygonal configuration, without departing from the spirit and scope of the present invention.

The tumbler 26 further comprises a door 56 coupled to the container 46, the door 56 being movable from a first position to a second position. In the first position, which is shown in Figures 5 and 6, the door 56 allows concrete blocks to be loaded into or unloaded from at least one of the plurality of compartments 48. In the second position, which is shown in Figures 3 and 4, the door 56 maintains the concrete blocks within the at least one of the plurality of compartments 48 such that rotation of the container 46 about its longitudinal axis causes the concrete blocks to tumble and collide with each other. The door 56 allows concrete blocks to be loaded into or unloaded from each of the plurality of compartments 48. The door 56 is pivotally coupled to the container 46 and is adapted to pivot between the first position and the second position. Alternatively, the door 56 may be slidably coupled to the container 46 and adapted to slide from the first position to the second position. In fact, it is understood that the door 56 may be realized by any type of movable barrier adapted to at least partially block or obstruct the opening into or from at least one of the plurality of compartments 48.

The tumbler 26 further comprises a drive motor 58 coupled to the container 46. The drive motor 58 is operative to cause rotation of the container 46 about its longitudinal axis. In addition, a brake (not shown) is coupled to the container 46 and is operative to stop or prevent the rotation of the container 46 about its longitudinal axis. In this particular embodiment, the drive motor 58 is a hydraulic motor and is coupled to an axle of the

container 46 via a gear 60, the axle being rotatably mounted in a bearing support assembly (not shown). A hydraulic power unit (not shown) provides a pressurized flow to the hydraulic motor 58 via a hydraulic line (not shown). Such hydraulic components are well known to those skilled in the art and will not be described in further detail in the present description. Advantageously, the hydraulic motor 58 can provide a large torque for rotating the container 46 which can have a relatively large weight, and thus large inertia, when loaded with concrete blocks. Nevertheless, it will be appreciated that, in other embodiments, the drive motor 58 can be an electric motor, a gas engine, or any other type of power unit without departing from the spirit and scope of the present invention.

The tumbler 26 further comprises an actuator 62 coupled to the door 56 and operative for moving the door 56 between the first and second positions of the door. In this specific embodiment, the actuator 62 is a hydraulic cylinder that is connected to the hydraulic power unit (not shown) via a respective hydraulic line (not shown). In alternate embodiments, the actuator 62 may be a pneumatic cylinder or an electric solenoid actuator. Such actuators are well known to those skilled in the art and will not be described in further detail in the present description.

In addition, the container 46 may also be provided with internal features that can further enhance the artificial ageing of the appearance of concrete blocks tumbled in the container 46. In Figure 10, the container 46 comprises an internal member 47 extending at least partially into the compartments 48 of the container 46. In this specific example, the internal member 47 is a cylindrical shaft extending substantially parallel to the longitudinal axis of the container 46, although it is to be understood that various other configurations of the internal member 47 are possible. Optionally, the internal member 47 comprises an external surface provided with protrusions 53 projecting into the compartments 48 of the container 46. In addition, the container 46 also comprises an internal surface 49 that is provided with similar protrusions 55 projecting into the compartments 48 of the container 46. Of course, it will be understood that, in the

embodiment of the container 46 in which each one of the compartments 48 is defined by a separate sub-container 51 (Figures 2 to 6), each sub-container 51 can be provided with an internal member 47 and protrusions 53 and 55 on the internal member 47 and the internal surface 49 of the sub-container 51. For example, multiple protrusions can be implemented by knurling the internal surface 49 of the container 46 and the external surface of the internal member 47. By providing such internal features, concrete blocks tumbled in the container 46 experience degradation of their surfaces, edges, and corners not only as a result of random collisions between the blocks themselves, but also as a result of collisions with the internal features of the container 46.

Referring now to Figures 11 to 13, there is shown an apparatus 24 for artificially ageing the appearance of surfaces, edges, and corners of concrete blocks, in accordance with a specific example of implementation of the invention. The apparatus 24 comprises a frame 28 and a plurality of tumblers 26 coupled to the frame 28. Each tumbler 26 is rotatably coupled to the frame 28 and is substantially identical to the tumbler 26 described in connection with Figures 2 to 6. Although in the embodiment shown in Figures 11 to 13 each tumbler 26 of the apparatus 24 is substantially identical to the tumbler 26 described in connection with Figures 2 to 6, it is to be understood that, in other embodiments, each tumbler 26 of the apparatus 24 may have a different construction and/or configuration.

As shown in Figures 11 to 13, the frame 28 comprises a base 64 and a tumbler support structure 66 pivotally coupled to the base 64. The base 64 and the tumbler support structure 66 are each constructed from an assembly of beams or truss members. The tumbler support structure 66 also comprises on each side thereof a shaft or axle 68 that is supported for rotation in a respective bearing 70 on each side of the base 64, thereby allowing the tumbler support structure 66 to rotate in relation to the base 64. For their part, each one of the tumblers 26 is rotatably coupled to the tumbler support structure 66. In the example shown, the axles projecting from the end plates 52 of each container 46 are supported for rotation in respective bearings 72 of the tumbler support structure 66, thereby allowing the container 46 of each tumbler 26 to rotate about its longitudinal axis.

Actuation and control of the motion of each of the components of the apparatus 24 is achieved as follows.

The hydraulic motor 58 of each tumbler 26 is connected via a respective hydraulic line (not shown) to a hydraulic distribution circuit (not shown) mounted in the center of the tumbler support structure 66. Similarly, the door actuator 62 of each tumbler 26, in the form of a hydraulic cylinder, is also connected to the hydraulic distribution circuit via a respective hydraulic line (not shown). Mounting the hydraulic distribution circuit in the center of the tumbler support structure 66 prevents entanglement of the hydraulic lines leading to the hydraulic motors 58 and actuators 62 during rotation of the tumbler support structure 66. The hydraulic distribution circuit is in fluid communication with a hydraulic power unit 73 that provides a pressurized flow to the hydraulic distribution circuit for distribution to the hydraulic motors 58 and actuators 62 of the tumblers 26. The hydraulic power unit 73 is located on the ground next to the base 64 and is connected to the hydraulic distribution circuit by a hydraulic line (not shown) passing through the shaft 68 and having a coupling ensuring that the hydraulic line does not twist during rotation of the tumbler support structure 66. In a variant implementation, the hydraulic power unit 73 is mounted in the center of the tumbler support structure 66 with the hydraulic distribution circuit.

The hydraulic distribution circuit and hydraulic power unit 73 are also respectively connected to a hydraulic control system 77 located remote from the frame 28 of the apparatus 24. The hydraulic control system 77 is operative to control variables such as the pressures and flow rates in the hydraulic power unit 73, the hydraulic distribution circuit, and the hydraulic motor 58 and actuator 62 of each one of the tumblers 26. The hydraulic control system 77 includes a computer in communication with an operator interface. The computer stores programs for automatically controlling the operation of the various hydraulic components for when the apparatus 24 is in an automated mode of operation. The operator interface, which includes a keyboard and a monitor, allows an operator to input programs into the computer, to monitor the operation of the various hydraulic

components, and also enables the operator to enter control commands in a manual mode of operation.

The hydraulic control system 77, the hydraulic power unit 73, and the hydraulic distribution circuit thus cooperate to control the operation of the hydraulic motor 58 and the actuator 62 of each one of the tumblers 26. Accordingly, the container 46 of each tumbler 26 can independently be set in rotation, stopped from rotating, or can have its rotational speed controllably varied. Furthermore, the hydraulic control system 77 allows the setting in rotation, ceasing of the rotation, or variation of the speed of rotation of the container 46 of each tumbler 26 to be effected either in an automated mode of operation or in a manual mode of operation. Similarly, the door 56 of each one of the tumblers 26 can independently be moved between the first position of the door 56 to enable loading or unloading of concrete blocks, and the second position of the door 56 to maintain the blocks in the container 46 during rotation of the container 46.

In order to actuate and control the motion of the tumbler support structure 66, the apparatus 24 comprises a motor 74 coupled to the tumbler support structure 66. The motor 74 is operative to cause the tumbler support structure 66 to pivot on the base 64 in order to move sequentially each one of the tumblers 26 from a first location, referred to as the block loading position BLP, to a second location, referred to as the block unloading position BUP. In the specific example of implementation shown in Figures 11 to 13, the motor 74 is an electric motor and is coupled to one of the shafts 68 of the tumbler support structure 66 by way of a chain and sprocket (not shown). In an alternative embodiment, the motor 74 is mounted on the base 64 proximate to the shaft 68 and is coupled thereto via a reducer gearbox.

The motor 74 is connected to a motor control system 79 located remote from the frame 28 of the apparatus 24. The motor control system 79 is operative to control the power supplied to the motor 74 and the rotational speed of the motor 74. The motor control

system 79 includes a computer in communication an operator interface which, in this specific embodiment, are respectively the same computer and operator interface as that of the hydraulic control system 77. As such, the hydraulic control system 77 and the motor control system 79 can be referred to as a control system 81 of the apparatus 24. The computer stores programs for automatically controlling the operation of the motor 74 for when the apparatus 24 is in an automated mode of operation. The operator interface allows an operator to input programs into the computer, to monitor the operation of the motor 74 and the rotation of the tumbler support structure 66, and also enables the operator to enter control commands in a manual mode of operation.

It will thus be appreciated that the control system 81 of the apparatus 24 interacts with the motor 74 and the hydraulic motor 58 of each one of the tumblers 26 to control the rotation of the tumbler support structure 66 in relation to the base 64 and the rotation of the container 46 of each one of the tumblers 26 about its longitudinal axis. Accordingly, the rotational speed of the tumbler support structure 66 and the respective rotational speed of the container 46 of each one of the tumblers 26 can be adjusted, either automatically or manually, on the basis of a desired rate of production of concrete blocks having an artificially aged appearance.

The design of control systems such as the control system 81 described above is well known to those skilled in the art and will not be described in further detail in the present description. Incidentally, it is to be understood that the specific implementation of the apparatus 24 described above was presented for purposes of example only and that various other implementations are possible without detracting from the scope of the present invention. For example, the motor 74 could be a hydraulic motor and could be connected to the hydraulic power unit 73 and hydraulic control system 77 of the apparatus 24. Also, in a variant implementation, a single motor, which could be a hydraulic motor, an electric motor, or any other type of motor, is adapted to drive the tumbler support structure 66 and the container 46 of each one of the tumblers 26 via a system of linkages.

Reverting to Figure 1, concrete blocks 12 intended to have their appearance artificially aged are disposed on a platform 14 that is adapted to move on a first conveyor 16. On the platform 14, the concrete blocks 12 are typically arranged in a certain layout which is the result of a prior processing operation. An example of a possible layout of the concrete blocks 12 is shown in Figure 14. In that particular example, the concrete blocks 12 are arranged in six rows of blocks having different dimensions, adjacent rows of blocks being separated by a certain distance. The conveyor 16 moves the platform 14 to a first position, denoted P1, where a pusher mechanism 18 pushes the concrete blocks 12 onto a second conveyor 20. In this specific implementation, the second conveyor 20 is a belt-type conveyor and optionally comprises a plurality of separating walls that define a plurality of channels 22. The pusher mechanism 18 is adapted to push the concrete blocks 12 of each row of blocks 12 on the platform 14 into a respective channel 22 of the conveyor 20.

The conveyor 20 conveys the concrete blocks 12 in each of the channels 22 toward an apparatus 24 for artificially ageing the appearance of the concrete blocks. In this example of implementation, the apparatus 24 is substantially identical to the apparatus described above in connection with Figures 11 to 13.

The control system 81 of the apparatus 24 controls the rotational speed of the tumbler support structure 66 such that, when the concrete blocks 12 arrive at the end of the conveyor 20, one of the tumblers 26 is at the block loading position BLP. The control system 81 can either completely stop the rotation of the tumbler support structure 66 or reduce the rotational speed of the structure 66 to a speed allowing proper introduction of the concrete blocks 12 into the container 46 of the tumbler 26. At the same time, if the container 46 is already rotating, the control system 81 either reduces the rotational speed of the container 46 or completely stops the rotation of the container 46. The control system 81 also causes the door 56 of the tumbler 26 to be in the first position allowing the concrete blocks 12 to be loaded into the compartments 48 of the tumbler 26. Thus, at the block loading position BLP, the tumbler 26 is positioned in relation to the conveyor 20 such that each respective compartment 48 of the tumbler 26 is aligned with a respective channel 22 of the conveyor 20 allowing the concrete blocks 12 in each one of the

channels 22 to be loaded into a respective compartment 48 of the tumbler 26. Also, in this particular embodiment, the conveyor 20 is adapted move in the direction indicated by the arrow "A". This enables the conveyor 20 to deliver concrete blocks directly into the container 46 at the block loading position BLP and to be retracted from the apparatus 24 during rotation of the tumbler support structure 66 when none of the tumblers 26 is positioned at the block loading position BLP ready to be loaded with concrete blocks.

Once the concrete blocks 12 are loaded into the tumbler 26, the tumbler support structure 66 rotates in order to move the tumbler 26 to the block unloading position BUP.

During movement of the tumbler 26 from the block loading position BLP to the block unloading position BUP, the control system 81 causes the container 46 of the tumbler 26 to be rotated about its longitudinal axis. At the same time, the control system 81 causes the door 56 to be in the second position thereby maintaining the concrete blocks 12 within the compartments 48 of the tumbler 26. Under rotation of the container 46, the concrete blocks 12 in each one of the compartments 48 tumble and collide with each other and with internal features of the container 46, such as an internal member 47 and protrusions 53 and 55 (Figure 10) if the container 46 includes such features. The multiple random collisions between the concrete blocks 12 and between the concrete blocks 12 and internal features of the container 46 damage the surfaces, edges, and corners of the concrete blocks 12 thereby imparting to the blocks 12 an aged or worn appearance.

When the tumbler 26 reaches the block unloading position BUP, the control system 81 of the apparatus 24 controls the rotational speed of the tumbler support structure 66 to allow unloading of the concrete blocks 12 from the tumbler 26 onto a third conveyor 32, which is similar in construction to the second conveyor 20. The control system 81 can either completely stop the rotation of the tumbler support structure 66 or reduce the rotational speed of the structure 66 to a speed allowing proper unloading of the concrete blocks 12 from the container 46 onto the conveyor 32. At the same time, the control system 81 either reduces the rotational speed of the container 46 or completely stops the rotation of the container 46 to, once again, allow proper unloading of the blocks 12. The control

system 81 also causes the door 56 of the tumbler 26 to be in the first position allowing the concrete blocks to be unloaded from the compartments 48 of the tumbler 26.

Thus, at the block unloading position BUP, the tumbler 26 is positioned in relation to the conveyor 32 such that each respective compartment 48 of the tumbler 26 is aligned with a respective channel 34 of the conveyor 32 allowing the concrete blocks 12 in each respective compartment 48 of the tumbler 26 to be unloaded into a respective one of the channels 34 of the conveyor 32. The conveyor 32 then conveys the concrete blocks 12 in each of the channels 34 toward a position denoted P2.

In the illustrated embodiment, the concrete blocks 12 arrive at position P2 on a fourth conveyor 36 and are directed towards a fifth conveyor 38 by a second pusher mechanism 40. Upon reaching the fifth conveyor 38, the concrete blocks 12 are directed towards the first conveyor 16 by a third pusher mechanism 42. The blocks 12 eventually reach a position denoted P3 where they are placed on the platform 14, which has moved from position P1 on the first conveyor 16, by a fourth pusher mechanism 44.

Once on the platform 14, the concrete blocks 12 may be directed to another location where they may be submitted to another processing operation or treatment. Alternatively, the concrete blocks 12 may form a layer of a pallet that may subsequently be stored or transported to another location. In that case, the concrete blocks 12 may be palletized through automatically palletized by way of a palletizing device. Of course, it will be appreciated that the fourth and fifth conveyors 36 and 38, along with the second, third, and fourth pusher mechanisms 40, 42, and 44 are optional and may be omitted in which case the concrete blocks 12 may be placed, for instance, on another platform (not shown) located at position P2. The concrete blocks 12 could then either be submitted to a further processing operation or palletized as described above.

It will thus be appreciated that the plurality of compartments 48 of the tumbler 26 allow the concrete blocks 12 introduced therein to be tumbled while maintaining together in a respective compartment 48 the blocks originally being part of each row of blocks 12 on

the platform 14. Upon unloading of the concrete blocks 12 from the tumbler 26 onto the conveyor 32, the blocks 12 originally being part of each respective row of blocks 12 are thus in the same respective channel 34 of the conveyor 32. Hence, when the concrete blocks 12 arrive on the platform 14 at position P3 (or, if that is the case, the platform (not shown) located at position P2), the blocks 12 originally being part of each respective row of blocks 12 are still in the same respective row. In other words, the concrete blocks 12 being part of a particular row of blocks 12 in a given layout of blocks prior to being tumbled in the tumbler 26 are part of the same row of blocks in the layout of blocks after being tumbled in the tumbler 26. As such, the layout of concrete blocks 12 after the blocks have been tumbled in and unloaded from the tumbler 26 is the same as the original layout of concrete blocks 12 prior to their introduction into the tumbler 26.

For instance, the concrete blocks 12 of the example layout of blocks 12 shown in Figure 14 may be loaded into the tumbler 26 with blocks B1 and C1 of row R1 being loaded into a first compartment 48 of the tumbler 26, blocks A2 and D2 of row R2 being loaded into a second compartment 48 of tumbler 26, and so on. After being tumbled and unloaded from the tumbler 26, the resulting layout of blocks has a first row that includes blocks B1 and C1, a second row that includes blocks A2 and D2, etc.

During movement of the tumbler 26 from the block loading position BLP to the block unloading position BUP, the tumbler support structure 66 has positioned another one of the tumblers 26 at the block loading position BLP. This other one of the tumblers 26 receives another set of concrete blocks 13 transported from a platform 15 to the block loading position BLP via the first conveyor 16, the pusher mechanism 18, and the second conveyor 20, as described previously. The concrete blocks 13 are then tumbled in this other one of the tumblers 26, unloaded at the block unloading position BUP, and make their way to position P3 where they are placed on the platform 15, as described above. Generally, while some of the tumblers 26 are moving from the block loading position BLP to the block unloading position BUP and tumbling respective sets of concrete blocks, one of the tumblers 26 is being loaded with a respective set of concrete blocks at

the block loading position BLP and another one of the tumblers 26 is being unloaded of a respective set of concrete blocks at the block unloading position BUP.

Thus, owing to the sequential movement of each one of the plurality of tumblers 26 from the block loading position BLP to the block unloading position BUP, it will be appreciated that multiple sets of concrete blocks can be tumbled simultaneously. Accordingly, a larger number of concrete blocks having an aged or weathered appearance can be produced per unit time thereby increasing the efficiency of the process.

Of course, while the above-described embodiment described using the apparatus 24 comprising a plurality of tumblers 26 to produce concrete blocks having an aged appearance, it is to be understood that a single tumbler 26 as described in connection with Figures 2 to 9 can be used to produce such concrete blocks without detracting from the spirit of the present invention.

The above description of the embodiments should not be interpreted in a limiting manner since other variations, modifications and refinements are possible within the spirit and scope of the present invention. The scope of the invention is defined in the appended claims and their equivalents.